Health Consultation

FORMER PARK RAPIDS DUMP

CITY OF PARK RAPIDS, HUBBARD COUNTY, MINNESOTA

EPA FACILITY ID: MND981526452

SEPTEMBER 30, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

FORMER PARK RAPIDS DUMP

CITY OF PARK RAPIDS, HUBBARD COUNTY, MINNESOTA

EPA FACILITY ID: MND981526452

Prepared by:

The Minnesota Department of Health
under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

FOREWORD

This document summarizes public health concerns at a dump site in Minnesota. It is based on a formal site evaluation prepared by the Minnesota Department of Health (MDH). A number of steps are necessary to do such an evaluation:

- Evaluating exposure: MDH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is found on the site, and how people might be exposed to it. Usually, MDH does not collect its own environmental sampling data. We rely on information provided by the Minnesota Pollution Control Agency (MPCA), U.S. Environmental Protection Agency (EPA), and other government agencies, businesses, and the general public.

- Evaluating health effects: If there is evidence that people are being exposed—or could be exposed—to hazardous substances, MDH scientists will take steps to determine whether that exposure could be harmful to human health. The report focuses on public health—the health impact on the community as a whole—and is based on existing scientific information.

- Developing recommendations: In the evaluation report, MDH outlines its conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of MDH in dealing with individual sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies—including EPA and MPCA. However, if there is an immediate health threat, MDH will issue a public health advisory warning people of the danger, and will work to resolve the problem.

- Soliciting community input: The evaluation process is interactive. MDH starts by soliciting and evaluating information from various government agencies, the organizations responsible for cleaning up the site, and the community surrounding the site. Any conclusions about the site are shared with the groups and organizations that provided the information. Once an evaluation report has been prepared, MDH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us.*

Please write to:	Community Relations Coordinator Site Assessment and Consultation Unit Minnesota Department of Health 625 Robert Street N. / Box 64975 St. Paul, MN 55164-0975
OR call us at:	(651) 201-4897 *or* 1-800-657-3908 (toll free call—press "4" on your touch tone phone)
On the web:	http://www.health.state.mn.us/divs/eh/hazardous/index.htmls

I. Summary of Background and History

The Minnesota Department of Health (MDH) received a request from the Minnesota Pollution Control Agency (MPCA) to evaluate potential public health concerns regarding the Former Park Rapids Dump located in the southeast corner of the city of Park Rapids, Hubbard County, Minnesota (the site). An investigation was recently conducted at the site by the MPCA using Brownfield grant funding from the U.S. Environmental Protection Agency (EPA). Though the existence of the site was known for some time, the MPCA and the current site owner, the Park Rapids Antique Tractor Club, determined that further investigation was warranted due to concern that the site could adversely impact public health or the environment. This health consultation is based on a site visit conducted by MDH staff, a meeting with local officials on May 4, 2006, and a review of information provided to MDH by the MPCA and its consultant, STS Consultants, LTD (STS 2006).

The site is located on a 40-acre parcel bounded by 8th Street East, South Henrietta Avenue, 12th Street East, and Eastern Avenue. The site location is shown in Figure 1, and a site map is presented in Figure 2. The dump itself occupies approximately one-third of the 40 acres, although the exact outline is not known. The parcel is home to the Park Rapids Antique Tractor Club, and contains several buildings including a meeting hall/office, equipment storage sheds, and unoccupied house, a small church, and several other buildings. The property also includes agricultural fields on the east side, an open grass parking area in the north part of the property, and a camping area with electrical and water hookups in the southwest corner. The property is used several times a year by the club to host tractor pulls, flea markets, and an annual show for antique farm equipment fans that draws sizeable crowds. The property is fenced and vehicle access is controlled by a locked gate. Surrounding land uses include a variety of city and rural residential, agricultural land, commercial use, and undeveloped land.

The site began accepting wastes in the mid-1950s, and was owned and operated until 1973 by the City of Park Rapids. The site may have contained one or more gravel pits prior to or even during its use as a dump (STS 2006). The wastes were reportedly burned regularly, and it has been reported that large amounts of rodenticide were used to control rats at the site. Cover materials at the time of closure likely consisted of native sandy soils. The site is now owned by the Park Rapids Antique Tractor Club.

According to available records, as an unregulated public dump the site accepted all types of wastes, including household garbage, wood wastes, demolition debris, appliances and vehicle-related wastes (oil, batteries, antifreeze, etc.); specific records are not available. It has also been alleged that electrical transformers containing polychlorinated biphenyls (PCBs) were disposed at the site, as well as arsenic-containing grasshopper bait that was commonly used in rural Minnesota at one time. The waste materials have mostly been covered with sandy fill and the surface re-graded, although some waste materials are currently exposed at the surface in several areas of the dump (see below). Based on the STS Phase II site investigation, the volume of waste at the site is estimated to be approximately 60,000 cubic yards.

The MPCA conducted a preliminary assessment of the site in 1986, and a "Screening Site Investigation" at the site in 1990 (MPCA 1991). The investigation involved six soil borings in the western half of the site. Soil composite and grab samples collected from the borings showed the presence of polynuclear aromatic hydrocarbons (PAHs) typically associated with the burning

of organic materials; no PCBs were detected. Elevated levels of metals, including arsenic, chromium, and lead were detected in some of the soil samples. Water samples were also collected from six residential wells located adjacent to the site (see below), located in all directions from the site. Very low levels of one of two volatile organic compounds (VOCs; acetone and methylene chloride) were detected in three wells, but the concentrations were only estimated. The VOCs are also common laboratory contaminants, so their presence in the sample is considered suspect. Various metals were also detected, including cadmium, lead, and thallium, some at concentrations exceeding current drinking water criteria, but not criteria in place at that time. At the completion of the Screening Site Inspection, the MPCA concluded that while some contamination of site soils had occurred from past operations, the contaminants did not appear to have impacted groundwater and were not highly mobile. The MPCA also concluded that no further actions were warranted at that time.

The tractor club operates at the site under a conditional use permit from the City of Park Rapids. The permit requires that any excavation at the site not exceed two feet in depth without a variance from the city. This requirement was put in place to prevent disturbance of the waste materials.

Geology/Hydrogeology

Based on geologic information provided by STS, soils at the site are composed primarily of sandy glacial deposits overlying glacial till (STS 2006). The uppermost bedrock is expected to be Precambrian granitic bedrock, at a depth of greater than 400 feet below ground. Soil borings conducted by STS showed less than one foot of sandy cover soils in some areas, overlying waste materials that are up to 20 feet thick in a few locations. Thin layers of silt and clay were found at depth in some borings.

The surficial groundwater flow is south-southeast. At the site, groundwater was encountered between 30 and 40 feet below grade. Ultimately four permanent monitoring wells were installed to collect water samples, and the flow direction beneath the site was confirmed as to the southeast. Multiple private water wells are located in the immediate vicinity of the site. The majority of private wells are shallow, approximately 75 feet deep or less, and in recent sampling have not shown evidence of contamination. Municipal water is available in the area, and serves residential properties to the north and northwest.

Site Visit

On May 4, 2006, MDH staff visited the Former Park Rapids Dump site with representatives of the MPCA and the Park Rapids Antique Tractor Club. The site is flanked by a cemetery and demolition waste/recycling facility to the east, vacant land to the west, residential and vacant land to the north, and rural residences to the south. Access to the property is restricted by a barbed-wire fence and locked gate.

There is cover across the much of the dump on the eastern and central portion of the property, consisting of mowed grass and native vegetation. There are many trees on and near the dump. Wastes, consisting of small pieces of slag, glass, asphalt, metals, small consumer-type batteries, and other materials were visible in areas of bare soil. These areas include disturbed soils near building foundations, in low areas along the gravel roads, in various small areas of bare soil or thin vegetation, and especially where test trenches had brought waste materials to the surface. The waste materials could pose a physical hazard to bare feet, as small pieces of broken glass

were fairly common. Some of these areas are located where people reportedly congregate to watch tractor pulls and other events, or picnic.

There are numerous small buildings on the property, including storage sheds, a small barn, an office/kitchen building, an unoccupied house, and a small chapel. Antique farm equipment is stored in various locations, both in the open and under cover. In the center of the site is a small playground with a swing set and sand box. A scale model railroad (of the size that can handle riders) is also present in the center of the site. Other items of interest include small ornamental garden plots next to some of the buildings, and a windmill that has an apparent hand-pump well below it with a water line leading to a watering trough. The water that comes from the pump and flows to the trough is provided from the facility well. It is not pumped from the ground at that location. There is a campground/RV park in the southwest corner of the site that is reportedly only used during the large show held in August of every year. There are nine electrical/water hookups serving the RV park.

Water at the facility is provided from an on-site well (MN unique well #601855) that is 71 feet deep. The well is located in the northern-central portion of the property (see Figure 2), and serves a network of hose bibs through piping installed by the tractor club. The piping system is drained and winterized with antifreeze in the fall, and flushed with water and bleach prior to the start of activities at the site in the spring until the water is free of odor. Wastewater is collected in septic tanks, and portable toilets are brought in for large events.

In the future the Park Rapids Antique Tractor Club would like to add various features such as a vehicle scale, updated ice cream shack, steam power generator, and bathrooms. These improvements would generally necessitate excavation below two feet for foundations or piping, which is not allowed under the city's conditional use permit. There is also interest on the part of the club to host additional events at the site.

Site Investigations: Soil and Waste Materials

In March of 1990, the MPCA drilled six soil borings on the site. Four borings were completed to a depth of 15 feet, one to 35 feet, and another to 55 feet. The borings generally encountered 0-2 feet of soil and/or up to 13 feet of refuse/fill, overlying at least 40 feet of fine to medium grained sand with varying amounts of silt and gravel and occasional silt or clay lenses. Waste was encountered in only four of the borings (B-3, B-4, B-5, and B-6), with only one boring (B-4) advanced through the main portion of the dump. An organic vapor monitoring device was used to screen the soil during drilling, but did not detect any measurable organic vapors. The locations of the 1990 MPCA soil borings are shown in Figure 3.

Soil samples were collected from each of the borings. Three of the soil samples were composites made up of soil from the entire length of the core (B-1, B-2, and B-4). The other four samples were "grab" samples collected within the refuse fill horizon (B-3, B-5, B-6) and at the top of a thick clay layer in B-3. Thirteen PAHs were detected in the samples from within the waste horizon in borings B-3, B-4, and B-6, with the highest concentrations being detected in the sample from B-6. Low concentrations (44 micrograms per kilogram, ug/kg) of the pesticide 4,4-DDT was detected in the sample from B-3 and low concentrations (24 ug/kg) of the pesticide endrin ketone was detected in the sample from B-6. Most of the metals detected appeared to be within normal background concentrations, with the exception of lead. Lead was detected in all of the soil samples, but the concentrations from the samples within the waste horizon of the

dump were several orders of magnitude greater than elsewhere: 28.9 – 225 mg/kg in borings B-3, B-4, B-5, and B-6. The 1990 soil sample data are presented in Table 1.

A second site investigation was conducted in 2005 by STS on behalf of the MPCA and the Park Rapids Antique Tractor Club (STS 2006). The purpose of the investigation was to try to determine the nature and extent of waste materials disposed at the site. The investigation consisted of an electromagnetic survey, nine soil borings, and 16 test trenches excavated to depths of up to eight to twelve feet below ground. Five of the nine soil borings were converted into temporary monitoring wells. The soil boring, test trench, and temporary well locations are shown in Figure 2.

The electromagnetic survey was conducted over most of the site, in lines about 50 feet apart, and was capable of detecting waste materials to a depth of approximately 15 feet. The survey identified a likely main waste disposal area in the center of the site, and several pockets of possible waste materials in the west and north part of the property. The areas appeared to be consistent with known historical disposal areas on the property. The test trenches were focused on the same suspect disposal areas. All together these areas occupy approximately nine acres of the site.

Waste materials including glass, metal, demolition debris (such as wood, concrete, brick, and asphalt), and ash were common in the test trenches. A sample of transite house siding from one test pit was later confirmed to contain 15% asbestos. The waste materials were mixed with sand, with the highest proportion being about 60% waste to 40% sand. The waste materials were typically darker in color than the native sand. The amount of cover material noted was generally low, less than six inches in some areas. Soil samples from the test pits and soil borings were screened for organic vapors using a photo ionization detector (PID) equipped with an 11.7 eV lamp calibrated to an isobutylene standard. No organic vapors were detected above background levels.

Ten surface soil (0-6 inches) grab samples plus one duplicate were collected from the locations where the test trenches were dug and analyzed for cyanide, PCBs, PAHs, pesticides, herbicides, diesel range organics (DRO), and metals. No cyanide, PCBs, pesticides, or herbicides were detected above the laboratory reporting limits in any of the samples. Low levels of PAHs were detected in six samples. The levels of PAHs were less than the MPCA Soil Reference Value (SRV). The SRVs represent the concentration of a contaminant in soil at or below which normal dermal contact, inhalation, and/or ingestion are unlikely to result in an adverse human health effect. The MPCA recreational SRVs were selected as the appropriate values for comparison with site data. Low levels of DRO (14-20 mg/kg) were found in three of the samples. There is currently no soil screening criterion for DRO. Elevated levels of metals were also found in many of the samples. Levels of copper, iron, and mercury exceeded their respective SRVs in one or more samples. Copper and iron are commonly found in soil. In Minnesota, concentrations range from one to 802 mg/kg with a mean of 12 mg/kg for copper and 43 to 20,826 mg/kg with a mean of 1,123 mg/kg for iron (MPCA 1990). It is unclear if the high levels or copper and iron found are strictly related to the waste materials in the dump or reflect, at least in part, naturally occurring metals. The mercury detection (7.6 mg/kg in TP-8) significantly exceeded its SRV of 1.2 mg/kg, and is unlikely to be from natural sources. The results of the surface soil samples can be found in Table 2; the sample locations are shown in Figure 2.

Soil and waste samples from the nine test pits were analyzed for volatile organic compounds (VOCs), PCBs, PAHs, DRO, herbicides, pesticides, cyanide, and selected metals. The samples were collected from between two and six feet below ground. No cyanide, VOCs, PCBs, pesticides or herbicides were detected in any of the soil samples. Levels of DRO were generally low, ranging from 24.2 to 179 mg/kg. Levels of PAHs, as expressed as benzo(a)pyrene equivalents, exceeded the (SRV) in one sample (TP-5). A number of metals (arsenic, chromium, iron, lead, mercury, nickel and zinc) exceeded their SRVs and/or MPCA tier one Soil Leaching Values (SLVs) in the many of the test trench samples. The SLVs represent the concentration of a contaminant in soil above which leaching could contaminate the groundwater to levels above established drinking water standards. Lead was as high as 5,040 mg/kg in TP-2 at a depth of two feet; the SRV is 300 mg/kg. The analytical results from the test trench soil/waste samples and the MPCA soil screening criteria are presented in Table 3.

Soil samples from beneath the waste were collected from nine test trenches to determine if contaminants had leached from the waste materials into native soils. The nine soil samples (plus one duplicate) were also analyzed for metals, cyanide, VOCs, PCBs, PAHs, DRO, pesticides, and herbicides. No cyanide, PCBs, pesticides, or herbicides were detected. DRO was detected in one soil sample at a relatively high concentration of 475 mg/kg. Two PAHs were detected in one sample at low levels. Low levels of metals were detected in the soil samples; only iron exceeded its SRV in two samples. The data are presented in Table 4.

Site Investigations: Groundwater

During the 2005 STS investigation, groundwater samples were collected from five temporary monitoring wells installed in soil borings at the site. Locations are shown in Figure 2. The samples were analyzed for metals, cyanide, PCBs, PAHs, DRO, pesticides and herbicides. No cyanide, PCBs, PAHs, DRO, pesticides or herbicides were found above laboratory detection limits. Manganese was the only metal detected, and was found in four of the five samples at levels ranging from 5.8 to 51.4 micrograms per liter (ug/L). These levels are well below the MDH Health – Based Value (HBV) for manganese of 1,000 ug/L. MDH has developed HBVs and Health Risk Limits (HRLs) for drinking water. The HBVs and HRLs represent levels of contamination in drinking water supplies that MDH considers safe for daily human consumption over a lifetime. The HRLs have been promulgated into rule, while the HBVs have not.

Groundwater samples were collected by STS on two occasions from the four permanent monitoring wells installed at the site. The monitoring well locations are shown in Figure 2; the data are presented in Table 5. These samples were analyzed for metals, cyanide, PCBs, PAHs, DRO, herbicides and pesticides. The metals samples were filtered in the field. No VOCs, PAHs, PCBs, herbicides, pesticides, or cyanide were detected in the monitoring well samples. DRO was detected at a level of 180 ug/L in a duplicate sample from MW-2. This level is below the MDH HBV of 200 ug/L. Metals, primarily manganese and thallium were detected in groundwater samples. The level of manganese was well below its HBV. Thallium levels exceeded the HRL for thallium of 0.6 ug/L in all but one of the monitoring well samples. Thallium concentrations ranged from 18.1 to 30.5 ug/L, with a relatively high detection limit of 15 ug/L.

Private Well Samples

In February of 1990, samples were collected by the MPCA from six private wells surrounding the site. The samples were analyzed for metals, cyanide, and VOCs. Three of the private well

samples were also analyzed for base-neutral acids, pesticides, and PCBs. The water was run at each location for approximately 15 minutes and then a sample was collected. Two VOCs were detected in some of the water samples, acetone and methylene chloride. Acetone is a common lab contaminant and was detected at low concentrations (23 and 29 ug/L) in one well and in the duplicate sample of another well, the initial sample of which did not contain acetone. Methylene chloride is also a common lab contaminant and was detected at a very low concentration (1 ug/L) in only one well. Bis(2-ethylhexyl)phthalate was detected at very low concentrations (2-3 ug/L) in all of the wells, and was also detected at 3 ug/L in the field blank and therefore also appears to be a laboratory contaminant. Three other VOCs (chloroform, 4-methyl-2-pentanone, and 2-hexanone) were detected only in the field blank.

Of the metals detected, seven were present at what could be considered elevated concentrations, but only two (silver and thallium) exceeded the current drinking water standard. Two wells (RW-1 and RW-12) had concentrations of thallium that exceeded the current HRL of 0.6 ug/L (2.7 and 2.3 ug/L, respectively). One well, RW-4, had concentrations of silver (73.1 ug/L) that exceeded the current HRL of 30 ug/L. All other metals were below the HRLs, and appear to be within normal background concentrations (except for some elevated zinc and lead levels, which were slightly above background). The locations of the 1990 (and later) private well samples are shown in Figure 4, and the metals data are shown in Table 6.

In March of 2003, MDH collected a sample from one private well located immediately south of the site, designated RW-12 in Figure 4. In June of 2003, MDH also collected a sample from the on-site well at the tractor club. The samples were analyzed for VOCs, metals, nitrates, and general chemistry parameters by the MDH laboratory. The metals data are presented in Table 6. Thallium was not one of the metals included in the analysis. In residential well RW-12, nitrate nitrogen was detected at a concentration of 3,800 ug/L. The MDH HRL for nitrate nitrogen is 10,000 ug/L. Low levels of barium and copper were also detected in the sample from RW-4. In the well located on the site, chloroform was detected at very low levels. The chloroform may have been produced as a result of chlorine bleach used to disinfect the well and distribution system each spring, a practice reported by the tractor club members. Chlorine can combine with natural organic material in water to form chloroform. Nitrate and multiple metals were also detected in the samples, none at concentrations exceeding the HRL.

The well on-site that serves the tractor club was also sampled by STS on two occasions in the fall of 2005. The samples were analyzed by Pace Laboratories for the same suite of parameters as the permanent monitoring well samples collected at the site. The only analytes detected in the samples were manganese and thallium. Thallium was detected in one of the two samples at a concentration of 21.2 ug/L, well above the HRL of 0.6 ug/L. The U.S. EPA has also established a one-day health advisory value for thallium of 7 ug/L (EPA 2004). The one-day health advisory is the concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for up to one day of exposure. The one-day health advisory is designed to protect a child weighing ten kilograms consuming one liter of water per day.

In the spring of 2006, MDH Drinking Water Protection program staff collected another sample from the well located on the tractor club site for analysis for metals, VOCs, pesticides, herbicides, and cyanide. The results show that the only metal detected was barium at a concentration of 36.7 ug/L; thallium was not detected above the reporting limit (1 ug/L).

Chloroform was again detected at a very low concentration, as was chloroethane. Both are likely a result of bleach being used to disinfect the well.

In the spring of 2006, MPCA staff collected samples from 10 private wells surrounding the site. This was done because of the prior detections of thallium in private wells near the site, and because of the thallium detection in the on-site well in the fall of 2005. The samples were analyzed by the MDH laboratory for the presence of 13 metals, including thallium. The locations of the private well samples are shown in Figure 4, and the metals data are presented in Table 6. Several metals were detected in the samples, including arsenic, copper, lead, and zinc. None were found at levels exceeding or even approaching their respective HRLs. Thallium was not reported in any of the samples, even though the lab was requested to estimate the level of any detection less than the formal reporting limit (1 ug/L).

II. Discussion

Dumps can pose a human health risk when people come into contact with chemicals in soil, water, or air at levels of health concern, or when people are exposed to physical hazards such as sharp objects or uneven ground. The Former Park Rapids Dump is a typical old city dump site because it is located on the edge of town, accepted all types of wastes, and had few if any controls on the type of wastes accepted. Rumors of PCB containing electrical transformers being disposed at the dump have not been confirmed by field investigations, however.

Waste materials in old dumps are often buried beneath a thin layer of whatever type of soil was easily available at the time. This is the case at the site, where cover materials are very thin in many areas and consist mainly of native sand. When cover materials are thin or absent, wastes and contaminants are exposed, and people or animals could come into contact with them. Over time, compaction and degradation of the waste result in settling and the emergence of irregular, often sharp objects such as scrap metal and broken glass that can pose a physical hazard. There are some exposed wastes at the site, including in areas frequented by people.

The degradation of solid waste can produce leachate when infiltrating water contacts the waste and dissolves chemicals from it. Leachate can discharge to surface water or infiltrate into groundwater. Groundwater contaminated by leachate usually does not have any distinguishing appearance, color, or taste, and people are rarely aware of any problem unless the water is tested. Soil with contaminant concentrations below the SLVs is not expected to generate contaminant concentrations in leachate at levels above groundwater or surface water criteria. Soils beneath the waste materials generally do not appear to have been impacted by leachate from the waste. The groundwater beneath the dump also does not show signs of dump-related contaminants, with the possible exception of manganese and thallium. Because thallium was detected in the groundwater but does not appear to be one of the major contaminants of concern in the waste itself it is unclear if it is strictly from the waste materials or are at least in part naturally occurring. Also, thallium was detected in one water supply well sample from the site (analyzed by Pace Laboratories) but was not detected in two others (analyzed by Pace Laboratories and the MDH Public Health Laboratory). Thallium was detected in two residential well samples in 1990, but was not detected in ten samples in 2006. According to the MPCA, thallium levels in groundwater in the Park Rapids area range from 0.004 to 0.01 ug/L (Dave Scheer, MPCA, personal communication, 2006), Additional monitoring is needed to determine if there are

seasonal trends or other influences on the concentration of thallium in the on-site well or other local private wells, or if there are analytical issues that are affecting the results.

In addition to the thallium detection in the on-site well, the main public health concerns at this site are potential physical hazards from visible wastes, and contaminated soil on and just below the surface of the dump. Surface soil samples have shown iron and copper at levels above SRVs, and mercury concentrations as high as 7.6 mg/kg, well above the SRV of 1.2 mg/kg. The inherent variability of soil sampling in a dump setting, where waste materials are likely to be heterogeneous, may indicate that contamination on the surface could be more extensive than the data indicate. In addition, only a few surface soil samples were collected in the obvious areas of bare soil/exposed wastes where people could come into contact with it (such as the playground area, roads, and grass sitting areas), so it is unclear to what extent children or adults may be exposed to contamination or physical hazards by their activities. With access to the site essentially unrestricted during shows and other events, there is opportunity for people to come into contact with waste materials and contaminated soil.

Samples from within the waste materials had levels of mercury, lead, arsenic that exceeded SRVs, and PAHs (in one sample), indicating contamination is present within the bulk of the dump site. Lead was as high as 5,040 mg/kg in TP-2. Several of these samples were collected at a relatively shallow depth (2 feet) indicating a significant risk of the waste being exposed as a result of even minimal excavation. The two-foot limit on excavation on the property put in place by the City of Park Rapids may not in fact be adequate to protect against future exposure. It may be more important to limit excavation to those areas where wastes are not present, and ensure that any wastes that are excavated are properly disposed of and not left uncovered on site.

Evaluation of Toxicity and Exposure to Site Contaminants

The main site contaminants of concern are lead, arsenic, and mercury in soil and waste and thallium in groundwater. While copper and iron were also found at high levels in some soil samples, they are common in Minnesota soils, and their presence may be at least in part due to natural processes. The information on lead, arsenic, and mercury is presented for informational purposes.

A completed exposure pathway exists when people come into contact with contaminated soil, sediments, water, air, or other environmental media. For a completed exposure pathway to represent a health issue, the concentration of contaminants must exceed levels of health concern and the exposure must be frequent or intense enough for the body to absorb the contaminants at levels that could increase the risk of adverse health effects.

Completed pathways exist for physical hazards, contaminated soil, and possibly for contaminated groundwater at and near the site. Casual exposure to contaminated soil at the site is not expected to cause the adverse health effects associated with these contaminants unless the exposure is unusually intense (such as ingestion of a large amount of soil) or occurs for prolonged periods, such as might occur in a residential setting. Thallium has been detected at a high concentration in one of three samples collected from the on-site well. Exposure to thallium at the concentration detected in one sample in the fall of 2005 could cause adverse health effects even from short-term exposure, especially in children, but it is unclear if the concentration found is representative of long-term conditions in the well.

Lead is one of the most common contaminants found at Superfund sites, and is also common in dump sites (ATSDR 1999). Elemental lead or lead compounds are or were used in a variety of products, including electrical batteries, ammunition, solder used in plumbing, gasoline additives, and paints. Its commercial use has been declining, and lead has been banned from use in gasoline since 1996. As a result of its past widespread use, however, lead is present throughout the environment and in the bodies of humans. The occurrence of an elevated blood lead level (a sign of lead exposure) in people, especially children, is still somewhat common as a result of the widespread presence of lead in the environment, and the health effects of exposure to lead are well documented.

Lead is toxic to many of the body's organ systems, including primarily the nervous system (ATSDR 1999). Long-term exposure to lead has been associated with decreased neurological function in workers exposed to lead on the job. High blood pressure is another possible effect from exposure to lead. Of greatest concern, however, is toxicity to the developing nervous system. Children between one and five years of age are also the most likely group in the general population to have high lead exposures because their behaviors (e.g. playing on the floor or ground, frequent hand-to-mouth contact) result in greater exposures than the behaviors of older children and adults to contaminated paint, dust, and soil, both in general and based on a per pound of body weight basis. Children who ingest large amounts of lead may develop brain damage (ATSDR 1999). Ingestion of smaller amounts of lead, at once or over time, may result in lesser effects on brain function. Childhood ingestion of lead may also result in anemia, kidney damage, colic, and muscle weakness. Exposure to low levels over time may affect physical and mental growth. Prenatal exposure may result in premature birth, low birth weight, and impaired development. Casual exposure to lead contaminated soil at the site is not expected to cause the adverse health effects associated with these contaminants unless the exposure is unusually intense (such as ingestion of a large amount of soil) or occurs for prolonged periods.

Arsenic is an element that is widely distributed in the Earth's crust (ATSDR 2005). Elemental arsenic is ordinarily a steel grey metal-like material that occurs naturally. However, arsenic is usually found in the environment combined with other elements such as oxygen, chlorine, and sulfur, referred to as inorganic arsenic. Most arsenic compounds are white or colorless powders that do not evaporate, and have no smell or unusual taste.

Inorganic arsenic occurs naturally in soil and in many kinds of rock, especially in minerals and ores that contain copper or lead. Arsenic is no longer produced in the United States; all of the arsenic used in the United States is imported. In the past, inorganic arsenic compounds were predominantly used as pesticides, including in grasshopper poison commonly used in Minnesota in the past.

Arsenic is often present in air, water, and food. Of these, food is usually the largest source of arsenic. Seafood is the most common source of arsenic in the diet, but the arsenic is in an organic form that is considered much less toxic. Inorganic arsenic has been recognized as a human poison since ancient times, and large oral doses (above 60,000 ug/L in food or water) can result in death. Ingestion of lower levels of inorganic arsenic (ranging from about 300 to 30,000 ug/L in food or water) may cause irritation of the digestive tract, with symptoms such as stomachache, nausea, vomiting, and diarrhea (ATSDR 2005). Other effects from ingestion of inorganic arsenic include decreased production of red and white blood cells, which may cause fatigue, abnormal

heart rhythm, blood-vessel damage resulting in bruising, and impaired nerve function causing a "pins and needles" sensation in the hands and feet.

The most characteristic effect of long-term oral exposure to inorganic arsenic are changes in the skin. These include a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso, and are often associated with changes in the blood vessels of the skin. A small number of the corns may ultimately develop into skin cancer. Swallowing arsenic has also been reported to increase the risk of cancer in the liver, bladder, kidneys, prostate, and lungs. The International Agency for Research on Cancer (IARC) has also determined that inorganic arsenic is carcinogenic to humans. EPA also has classified inorganic arsenic as a known human carcinogen. If you have direct skin contact with inorganic arsenic compounds, your skin may become irritated, with some redness and swelling. However, it does not appear that skin contact is likely to lead to any serious internal effects. Again, casual exposure to arsenic contaminated soil at the site is not expected to cause the adverse health effects associated with these contaminants unless the exposure is unusually intense (such as ingestion of a large amount of soil) or occurs for prolonged periods.

Mercury occurs naturally in the environment and exists in three basic forms (ATSDR 1999). These three forms are: metallic mercury (also known as elemental mercury), inorganic mercury, and organic mercury. Metallic mercury is a shiny, silver-white metal that is a liquid at room temperature. Metallic mercury is the basic elemental form of mercury. Metallic mercury is the familiar liquid metal used in thermometers and some electrical switches. Inorganic mercury compounds occur when mercury combines with elements such as chlorine, sulfur, or oxygen. Some inorganic mercury compounds are used as fungicides. Most of the mercury that occurs in the environment is in the form of metallic mercury and inorganic mercury compounds. In the United States, metallic and inorganic mercury enters the air mainly from the emissions of coal-fired power plants and from burning municipal and medical waste that contains mercury (for example, in thermometers, electrical switches, fluorescent light bulbs, or batteries that have been thrown away). Inorganic mercury may also enter water or soil from the weathering of rocks that contain mercury. Inorganic compounds of mercury may also be released to the water or soil if mercury-containing fungicides are used.

Because mercury occurs naturally in the environment, everyone is exposed to very low levels of mercury in air, water, and food. Exposure to mercury compounds at hazardous waste sites is much more likely to occur from handling contaminated soil (i.e., children playing in or eating contaminated surface soil), drinking contaminated well water, or eating fish from contaminated waters near those sites. When inorganic mercury compounds are swallowed, generally less than 10% is absorbed through the intestinal tract; however, up to 40% may enter the body through the stomach and intestines in some instances (ATSDR 1999). Some inorganic mercury can enter your body through the skin, but only a small amount will pass through your skin compared to the amount that gets into your body from swallowing inorganic mercury.

The nervous system is very sensitive to mercury. Permanent damage to the brain has been shown to occur from exposure to sufficiently high levels of metallic mercury. Whether exposure to inorganic mercury results in brain or nerve damage is not as certain, since it does not easily pass from the blood into the brain. The kidneys are also sensitive to the effects of mercury, because mercury accumulates in the kidneys and causes higher exposures to these tissues, and thus more damage. In addition to effects on the kidneys, inorganic mercury can damage the

stomach and intestines, producing symptoms of nausea, diarrhea, or severe ulcers if swallowed in large amounts. Effects on the heart have also been observed in children after they accidentally swallowed mercuric chloride. Symptoms included rapid heart rate and increased blood pressure. There is little information on the effects in humans from long-term, low-level exposure to inorganic mercury. Casual exposure to mercury contaminated soil at the site is not expected to cause the adverse health effects associated with these contaminants unless the exposure is unusually intense (such as ingestion of a large amount of soil) or occurs for prolonged periods.

Thallium is a soft, bluish-white metal that is widely distributed in trace amounts in the earth's crust (ATSDR 1992). Thallium is present in air, water, soil, and food products. It generally occurs combined with other substances such as bromine, chlorine, fluorine, and iodine to form salts. These combinations may appear colorless to white or yellow. Thallium remains in the environment since it is an elemental metal and cannot be broken down. Thallium exists in two chemical states (thallous and thallic). The thallous state is the more common and stable form. Thallous compounds are the most likely form to which you would be exposed in the environment. The significant, likely routes of exposure near hazardous waste sites are through swallowing thallium-contaminated soil or dust, drinking contaminated water, and skin contact with contaminated soil.

Thallium is used mostly in the manufacture of electronic devices, switches, and closures. Up until 1972 thallium was used as a rat poison, but its use was banned because of its potential toxicity. Thallium is no longer produced in the United States.

Exposures to thallium in air and water are generally very low. The greatest exposure usually occurs from food, mostly home-grown fruits and green vegetables contaminated by thallium found in soil. Small amounts of thallium are released into the air from coal-burning power plants, cement factories, and smelting operations. This thallium falls out of the air onto nearby soil. Thallium enters food because it is easily taken up by plants through the roots. Very little is known on how much thallium is in specific foods grown or eaten. Cigarette smoking is also a source of thallium.

When thallium is swallowed most of it is absorbed and rapidly goes to various parts of the body, especially the kidney and liver. Thallium is slowly eliminated in urine and to a lesser extent in feces. About half the thallium that enters various parts of the body is cleared within three days. Thallium can affect the nervous system, lung, heart, liver, and kidney if large amounts are eaten or drunk for short periods of time. Temporary hair loss, vomiting, and diarrhea can also occur and death may result after exposure to large amounts of thallium for short periods. Short-term exposure to thallium at the levels found in one of three well samples at the site could result in the adverse health effects described, especially in children. Little information is available on health effects in humans after exposure to smaller amounts of thallium for longer periods.

Child Health Considerations

ATSDR recognizes that the unique vulnerabilities of infants and children make them of special concern to communities faced with contamination of their water, soil, air, or food. Children are at greater risk than adults from certain kinds of exposures to hazardous substances at waste disposal sites. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are smaller than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children also weigh less, resulting in higher doses of

chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Children may be attracted to contaminants in bare soils at the site due to the presence of exposed debris such as shiny metal objects, glass, cinders, etc. The location of the dump near a residential area could also attract children. Access to the site is restricted by a fence, but the site is unattended, and there are some relatively isolated and wooded locations that would preclude observation by adults. Children are present on the site during public events, and school field trips to the site were at one time a regular occurrence.

III. Conclusions

Based on a review of available information in MPCA files and a site visit conducted on May 4, 2006, this site poses an indeterminate public health hazard. The identified hazards include physical hazards from exposed wastes and chemical hazards from potential contact (through dermal contact, incidental ingestion, or inhalation of dust) with contaminated surface soils or waste materials. The indeterminate conclusion is based on the fact that while contaminants are present in surface soils and wastes at levels of health concern, the extent of the contamination has not been fully characterized and the frequency and extent of human exposure is unclear. Thallium has been detected at concentrations of health concern in one of three samples from the on-site well, and in two samples from nearby private wells collected in 1990. Additional samples are needed to determine the extent of contamination in drinking water supplies.

IV. Recommendations

1. Areas of bare soil and/or exposed wastes should be covered with an clean cover soil meeting MPCA requirements (typically two feet) to prevent exposure to physical hazards and contaminated soils as soon as practically achievable. In the short-term, temporary cover using straw, wood chips, or other materials could be used to provide a barrier (this has been completed).
2. The on-site well and selected surrounding private wells should be monitored for dump-related contaminants, especially thallium, on a regular basis until their presence or absence over the long-term can be confirmed.
3. The water supply well on the site should not be used for potable purposes unless and until regular monitoring shows it is free of contaminants above levels of health concern. Alternately, the well should be sealed and a connection made to the Park Rapids municipal water supply (this has been completed).
4. Local residents should avoid trespassing on the site.
5. Excavation in waste materials at the site should be avoided if at all possible. If it is unavoidable, proper steps should be taken to ensure that any waste materials excavated are properly disposed off-site.

6. Institutional controls, such as a notice filed with the property deed, should be enacted to record the location of the dump for future reference. This could also help to memorialize the location of the waste deposits within the site property to help ensure that waste materials are not accidentally excavated or exposed.

V. Public Health Action Plan

MDH's Public Health Action Plan for the site will consist of:

1. A letter to the MPCA, to city and county authorities, and to the site owners advising them of these conclusions and recommendations;

2. Communication with local residents; and

3. A review of any additional available data, and participation in any meetings or other public outreach activities.

VI. References

Agency for Toxic Substances and Disease Registry. Toxicological profile for thallium. Atlanta: US Department of Health and Human Services; July 1992.

Agency for Toxic Substances and Disease Registry. Toxicological profile for mercury. Atlanta: US Department of Health and Human Services; March 1999.

Agency for Toxic Substances and Disease Registry. Toxicological profile for lead. Atlanta: US Department of Health and Human Services; July 1999.

Agency for Toxic Substances and Disease Registry. Toxicological profile for arsenic. Atlanta: US Department of Health and Human Services; September 2005.

EPA 2004. 2004 Edition of the Drinking Water Standards and Health Advisories. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. Winter 2004. Accessed online at: http://www.epa.gov/waterscience/criteria/drinking/

MPCA 1990. Soil Data for Minnesota. Memorandum from Dale Trippler and Mark Schmitt to MPCA staff. Minnesota Pollution Control Agency, St. Paul, Minnesota. September 25, 1990.

MPCA 1991. Screening Site Inspection Report, Park Rapids Former City Dump. Minnesota Pollution Control Agency, St. Paul, Minnesota. April 15, 1991.

STS 2006. Phase II Environmental Site Assessment, Former Park Rapids Dump. STS Consultants, LTD, Maple Grove, Minnesota. February 28, 2006.

Preparer of Report

James Kelly, M.S.
Health Assessor
Site Assessment and Consultation Unit
Minnesota Department of Health
tel: (651) 201-4910
james.kelly@health.state.mn.us

CERTIFICATION

This Former Park Rapids Dump Health Consultation was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

Alan Parham
Technical Project Officer, SPS, SSAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Alan Yarbrough
Chief, State Program Section, SSAB, DHAC, ATSDR

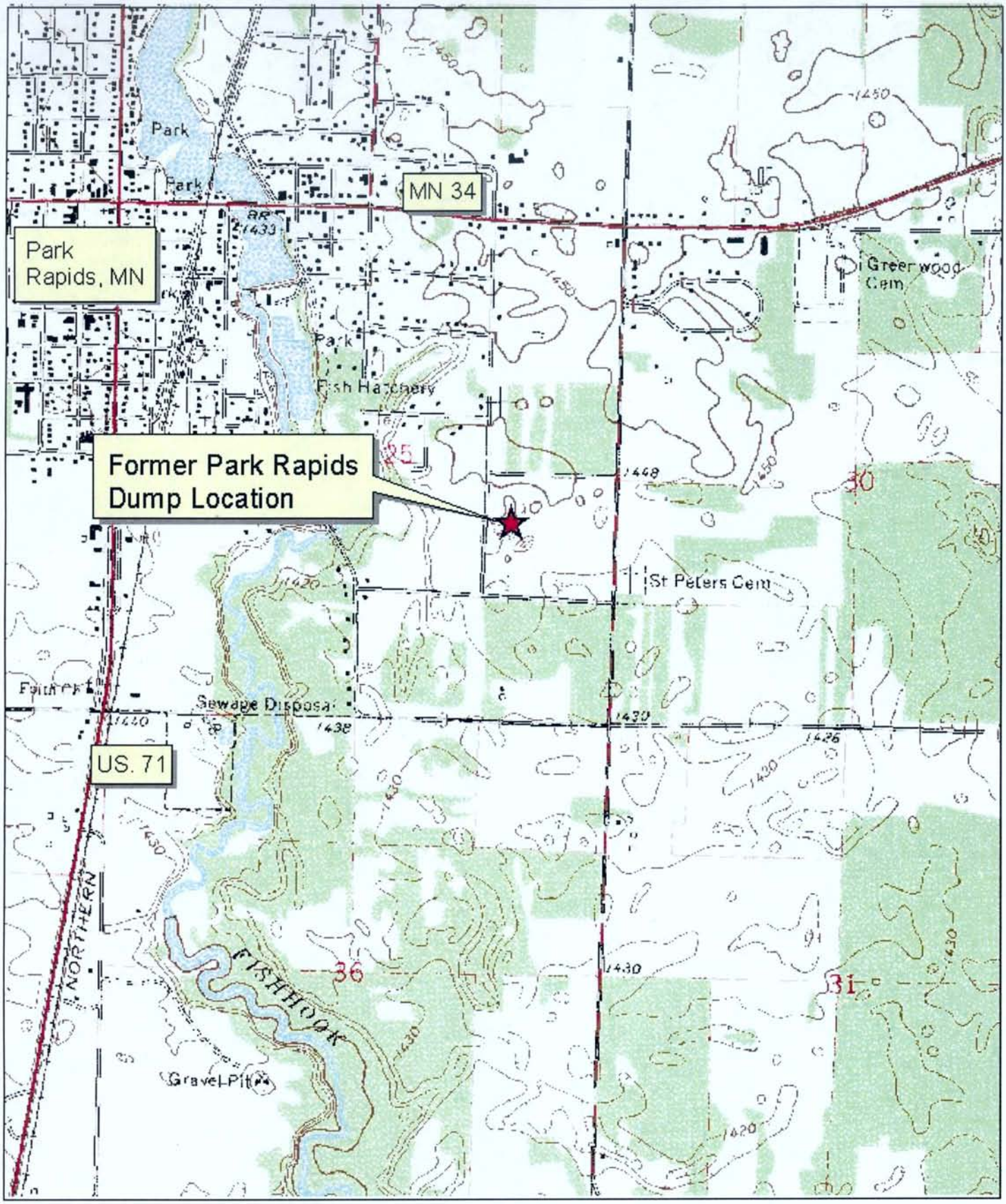
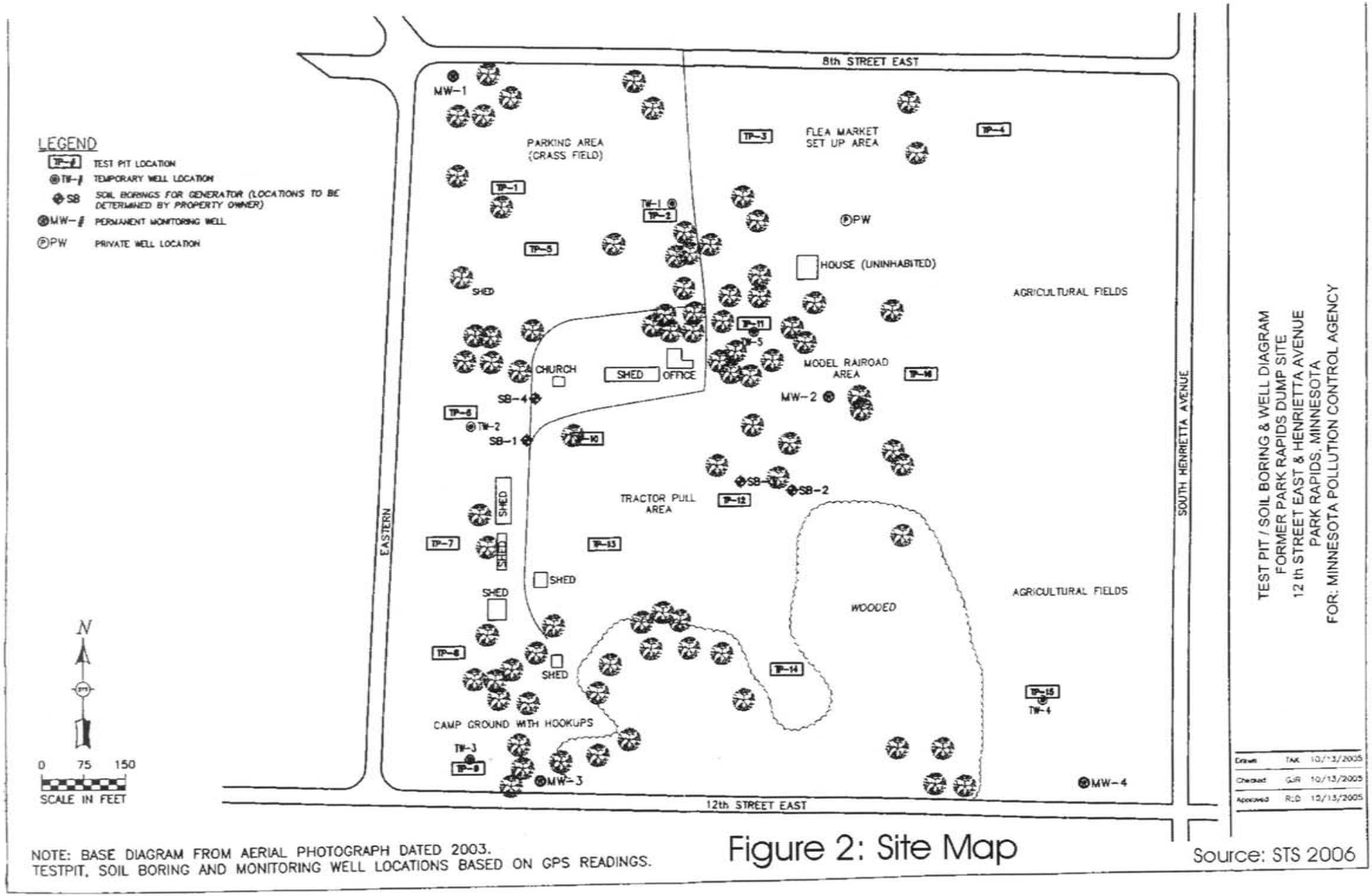


Figure 1: Park Rapids City Dump Site Location



NOTE: BASE DIAGRAM FROM AERIAL PHOTOGRAPH DATED 2003.
TESTPIT, SOIL BORING AND MONITORING WELL LOCATIONS BASED ON GPS READINGS.

Figure 2: Site Map

Source: STS 2006

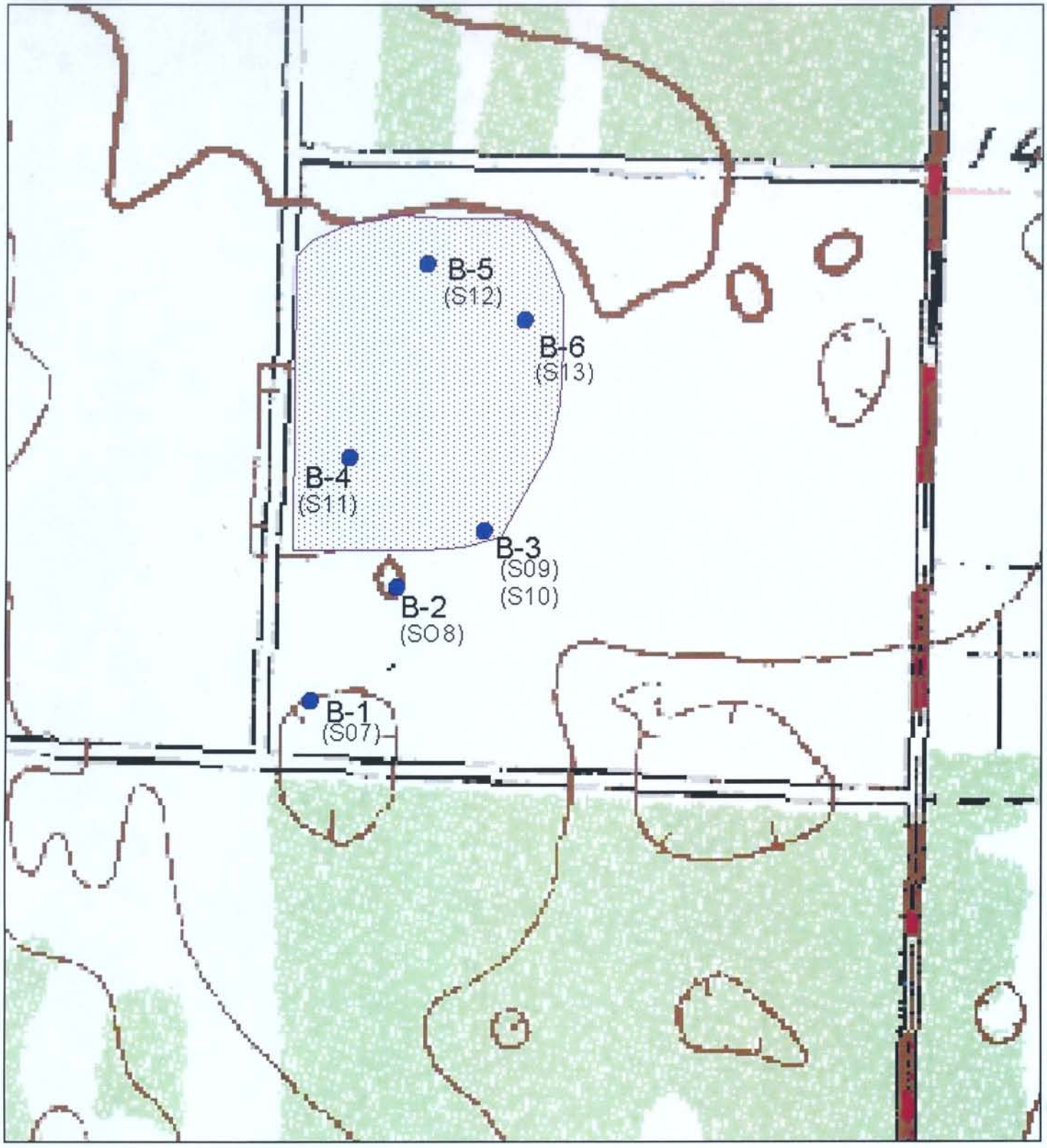


Figure 3: 1990 MPCA Soil Investigation Borings

N

● Approximate location of soil borings
(numbers in parantheses are sample numbers)

Area in which borings encountered refuse

0 100 200 300 400 500 Feet

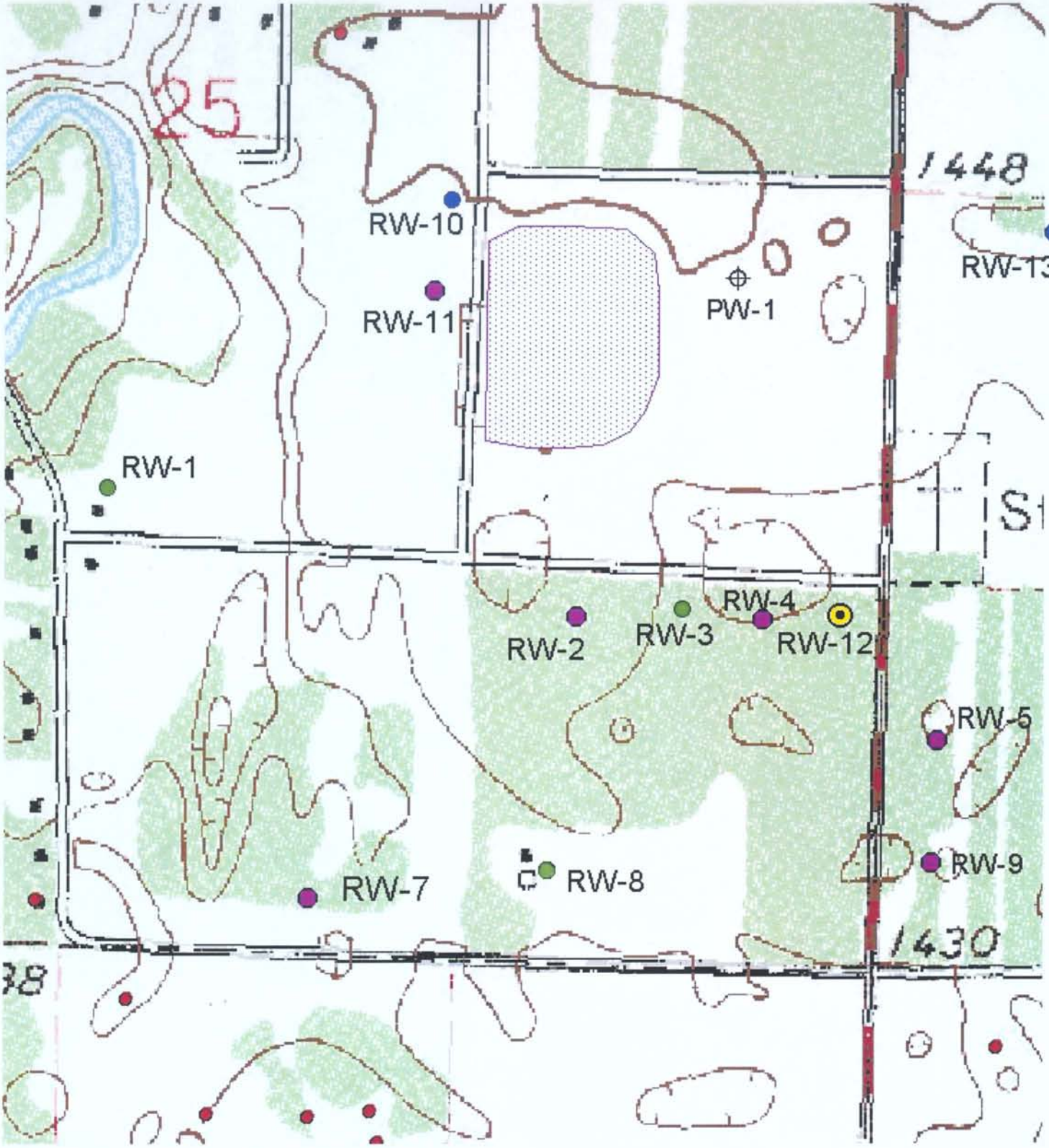


Figure 4: Private Well Sample Location Map

Approximate location of dump

0 0.05 0.1 0.15 0.2 0.25 Miles

- Residential well sample location: 1990 only
- Residential well sample location: 1990 and 2006
- Residential well sample location: 1990, 2003, 2006
- Residential well sample location: 2006 only

N

Table 1
1990 MPCA Soil Boring Analyses
(mg/kg)

	B-1 (S07)	B-2 (S08)	B-3 (S09)	B-3 (S10)	B-4 (S11)	B-5 (S12)	B-6 (S13)	B-3 (D02)	SLV	SRV
Metals										
Arsenic			3.7		2.1	3.2			15.1	5
Aluminum	2490 J	1480 J	4770 J	2160 J	4000 J	4430 J	4720 J	3080 J	NE	40000
Barium			173 J		67.8 J	115 J	98.2 J		842	1,200
Cadmium			1.4		0.98	0.87			4.4	35
Calcium	8930 J	16100 J	16400 J	23600 J	4200 J	14400 J	3150 J	24200 J	NE	NE
Chromium*	5.8	5.4	12.1	8.3	9.8	12	8.1	9.1	18	120
Copper	6.6	3.6	39.4	5.3	17.6	22.6	10	6.5	400	11
Iron	5690	3440	14300	5410	8630	18900	7140	7350	NE	12000
Lead	2.9 J	0.73 J	163 J	3.5 J	125 J	225 J	28.9 J	2.8 J	525	300
Magnesium	2280 J	3580 J	2170 J	5500 J	1670 J	4110 J	1180 J	7780 J	NE	NE
Manganese	119	66	340	136	184	367	421	187	NE	5000
Nickel			14.8		9.9	7.4			88	800
Selenium				1.1					1.5	200
Silver						1.9			3.9	200
Vanadium			13		10.4	11.4	10.1	11.3	500	40
Zinc	9.4 J	5.7 J	460 J	11.5 J	180 J	210 J	65.2 J	13.4 J	1500	12000
Polyaromatic Hydrocarbons - PAHs										
Benzo(b)fluoranthene			0.98		1.3		19			
Benzo(a)pyrene			0.66		0.72		9.9			
Indeno(1,2,3-cd)pyrene			0.61		0.59		1.9			
Dibenz(a,h)anthracene			0.13		0.12		3.4			
Benzo(g,h,I)perylene			0.68		0.38		5.2			
Benzo(a)pyrene equivalents			0.892		0.976		13.9		10.2	2
Pesticides EPA 8081										
Endrin ketone							24 J		NE	10
4,4-DDT			44						NE	18

* = denotes value for total chromium (chromium (III) + chromium (VI)). SLV/SRV are for chromium VI only
J = Compound was detected but numerical value is estimated because QC criteria were not met.
SLV = MPCA Soil Leaching Value
SRV = MPCA Soil Reference Value, Tier 2 (Recreational)
NE = Not Established

= Concentration exceeds SLV
= Concentration exceeds SRV

Source: MPCA 1991

Table 2
2005 Surface Soil Analyses
(mg/kg)

	TP-2 Surface	TP-4 Surface	TP-5 Surface	TP-6 Surface	TP-8 Surface	TP-9 Surface	TP-11 Surface	TP-12 Surface	TP-15 Surface	TP-16 Surface	SLV	SRV
Diesel Range Organics - DRO	14.4		**19.9**								**NE**	**NE**
Metals: Analyzed by EPA Method 6010	(only detected metals are shown)											
Arsenic					**3.5**						**15.1**	**5**
Berylium					**0.23**			**0.23**			**1.4**	**75**
Cadmium	**0.27**	**0.36**	**0.15**	**0.15**	**0.35**	**0.097**	**0.13**	**0.062**	**0.067**	**0.081**	**4.4**	**35**
Chromium*	**9.1**	**8**	**7.6**	**7.5**	**11.4**	**8.2**	**10.3**	**12**	**7.4**	**8.3**	**18**	**120**
Copper	**10.3**	**18.5**	**6.3**	**6.2**	**13.8**	**5**	**5.8**	**4.4**	**2.5**	**3.6**	**400**	**11**
Iron	**9520**	**7580**	**8710**	**7230**	**24500**	**9070**	**8500**	**11000**	**7260**	**8530**	**NE**	**12000**
Lead	**52.4**	**64.5**	**20.7**	**33.4**	**68.1**	**9.4**	**48.5**	**5.5**	**3.5**	**4.8**	**525**	**300**
Manganese	**288**	**261**	**210**	**199**	**579**	**229**	**178**	**185**	**188**	**212**	**NE**	**5000**
Nickel	**6.6**	**5.4**	**5.1**	**5.2**	**6.2**	**6**	**7.8**	**7.5**	**4.4**	**5.1**	**88**	**800**
Silver	**1.5**	**1.4**	**1.1**	**1.2**	**3.7**	**1.4**	**1.5**	**1.7**	**1**	**1.2**	**3.9**	**200**
Zinc	**90.6**	**77.2**	**56.6**	**47.4**	**86.3**	**24.2**	**32.9**	**23.7**	**15.6**	**18.8**	**1500**	**12000**
Mercury	**0.035**	**0.1**		**0.04**	**7.6**	**0.03**	**0.033**				**1.6**	**1.2**
Cyanide - EPA 9010A	No detects for all compounds analyzed										**varies**	**varies**
Polychlorinated Biphenyls - PCBs EPA 8082	No detects for all compounds analyzed										**varies**	**varies**
Polyaromatic Hydrocarbons - PAHs EPA 8270												
Benzo(a)pyrene equivalents		**0.884**	**1.066**		**0.495**						**10.2**	**2**
Pesticides/Herbicides	No detects for all compounds analyzed											

* = denotes value for total chromium (chromium (III) + chromium (VI)). SLV/SRV are for chromium VI only
SLV = MPCA Soil Leaching Value
SRV = MPCA Soil Reference Value, Tier 2 (Recreational)
NE = Not Established
Bold = Concentration above detection limits

= Concentration exceeds SLV
= Concentration exceeds SRV

Source: STS 2006

Table 3
2005 Waste Analyses
(mg/kg)

	TP-1, 3 ft.	TP-2, 2 ft.	TP-4, 2 ft.	TP-5, 4 ft.	TP-6, 6 ft.	TP-8, 2 ft.	TP-9, 2 ft.	TP-11, 4 ft.	TP-14, 2 ft.	TP-44, 2 ft. (Dup of TP-4)	SLV	SRV
Diesel Range Organics - DRO	**31.6**	**24.2**	**41.3**	**82.4**						**179**	**NE**	**NE**
Metals: Analyzed by EPA Method 6010	(only detected metals are shown)											
Arsenic								**25.3**			**15.1**	**5**
Berylium		**0.38**				**0.5**		**1.5**			**1.4**	**75**
Cadmium	**3.3**	**3.2**	**0.3**	**0.17**	**0.043**	**0.2**	**0.16**	**3.2**		**0.29**	**4.4**	**35**
Chromium*	**57.9**	**31.2**	**8.4**	**9.6**	**9.4**	**10.8**	**7.2**	**26.6**	**6.1**	**9.5**	**18**	**120**
Copper	**154**	**138**	**17.4**	**6.7**	**5.2**	**8.3**	**5.9**	**118**	**1.7**	**17.1**	**400**	**11**
Iron	**66200**	**206000**	**8750**	**8520**	**6580**	**10900**	**8600**	**59900**	**5660**	**7250**	**NE**	**12000**
Lead	**2370**	**5040**	**46.7**	**20.3**	**11.6**	**18.4**	**12.8**	**764**		**52.9**	**525**	**300**
Manganese	**421**	**1310**	**273**	**207**	**128**	**221**	**334**	**443**	**104**	**264**	**NE**	**5000**
Nickel	**131**	**15.2**	**5.8**	**6**	**5.7**	**7.4**	**5.1**	**18.3**	**4.4**	**5.6**	**88**	**800**
Selenium								**1.4**			**1.5**	**200**
Silver	**0.99**	**1.1**						**1.3**			**3.9**	**200**
Zinc	**2030**	**3870**	**77.4**	**81.9**	**16.3**	**83.9**	**31.6**	**2090**	**8.2**	**72.5**	**1500**	**12000**
Mercury	**0.66**	**0.26**	**0.081**	**0.038**		**0.044**	**0.04**	**5.3**		**0.071**	**1.6**	**1.2**
Cyanide - EPA Method 9010A	No detects for all compounds analyzed										**varies**	**varies**
Polychlorinated Biphenyls - PCBs EPA 8082	No detects for all compounds analyzed										**varies**	**varies**
Polyaromatic Hydrocarbons - PAHs EPA 8270												
Benzo(a)pyrene equivalents		**0.882**		**9**							**10.2**	**2**
Pesticides/Herbicides	No detects for all compounds analyzed											

* = denotes value for total chromium (chromium (III) + chromium (VI)). SLV/SRV are for chromium VI only
SLV = MPCA Soil Leaching Value
SRV = MPCA Soil Reference Value, Tier 2 (Recreational)
NE = Not Established
Bold = Concentration above detection limits

= Concentration exceeds SLV

= Concentration exceeds SRV

Source: STS 2006

Table 4
2005 Soil Below Waste Analyses
(mg/kg)

	TP-1, 6 ft.	TP-2, 10 ft.	TP-4, 8 ft.	TP-5, 10 ft.	TP-6, 21 ft.	TP-8, 4 ft.	TP-9, 6 ft.	TP-11, 11 ft.	TP-14, 6 ft.	TP-22, 10 ft. (Dup of TP-2)	SLV	SRV
Diesel Range Organics - DRO								**475**			**NE**	**NE**
Metals: Analyzed by EPA Method 6010	(only detected metals are shown)											
Arsenic											**15.1**	**5**
Berylium							**0.38**				**1.4**	**75**
Cadmium				**0.066**	**0.14**						**4.4**	**35**
Chromium*	**9.7**	**4.2**	**6.2**	**8.2**	**5**	**7.8**	**14.1**	**5.3**	**4.2**	**6.5**	**18**	**120**
Copper	**4.3**	**2.5**	**2.5**	**4.9**	**17.5**	**2**	**5.4**	**1.7**	**1.1**	**3.5**	**400**	**11**
Iron	**9650**	**3880**	**6660**	**7370**	**5450**	**6700**	**14500**	**5070**	**4620**	**4980**	**NE**	**12000**
Lead	**0.54**	**0.33**	**0.9**	**9**	**10.8**		**2.6**	**0.46**		**2.7**	**525**	**300**
Manganese	**167**	**73.6**	**107**	**168**	**70.8**	**121**	**246**	**86.3**	**72**	**100**	**NE**	**5000**
Nickel	**7.1**	**3.4**	**5**	**5.6**	**3.5**	**5.7**	**9.4**	**4.2**	**3.4**	**4.7**	**88**	**800**
Zinc	**10.5**	**5.9**	**11.3**	**27.8**	**26.3**	**7.9**	**26.7**	**7**	**4.7**	**10.7**	**1500**	**12000**
Mercury											**1.6**	**1.2**
Cyanide - EPA 9010A	No detects for all compounds analyzed										**varies**	**varies**
Polychlorinated Biphenyls - PCBs EPA 8082	No detects for all compounds analyzed										**varies**	**varies**
Polyaromatic Hydrocarbons - PAHs EPA 8270												
Fluoranthene				**0.455**							**295**	**1290**
Pyrene				**0.433**							**272**	**1060**
Pesticides/Herbicides	No detects for all compounds analyzed											

* = denotes value for total chromium (chromium (III) + chromium (VI)). SLV/SRV are for chromium VI only
SLV = MPCA Soil Leaching Value
SRV = MPCA Soil Reference Value, Tier 2 (Recreational)
NE = Not Established
Bold = Concentration above detection limits

= Concentration exceeds SLV

= Concentration exceeds SRV

Source: STS 2006

Table 5
October 2005 Groundwater Sample Analyses
(ug/L)

	MW-1		MW-2		MW-3		MW-4		MW-5 (Dup. of MW-2)		Standard	Source
Sample Date	10/10/2005	10/25/2005	10/10/2005	10/25/2005	10/10/2005	10/25/2005	10/10/2005	10/25/2005	10/10/2005	10/25/2005		
Metals	only metals detected are listed											
Copper	<10	<10	<10	<10	<10	<10	<10	<10	<10	**10.1**	**1,000**	**HBV**
Iron	<50	<50	<50	<50	<50	<50	<50	<50	<50	**51.5**	**NE**	
Manganese	**13.7**	**5.8**	<5	<5	**6.7**	<5	**7.4**	<5	<5	**7.2**	**1,000**	**HBV**
Thallium	**24.0**	**29.4**	**25.3**	**27.9**	**23.2**	**30.5**	**21.8**	<15	**22.2**	**18.1**	**0.6**	**HRL**
Cyanide - EPA Method 9010	No detects for all compounds analyzed											
Votatile Organics Compounds - VOCs EPA 8260	No detects for all compounds analyzed										**varies**	**varies**
Polychlorinated Biphenyls - PCBs EPA 8082	No detects for all compounds analyzed										**varies**	**varies**
Polyaromatic Hydrocarbons - PAHs EPA 8270	No detects for all compounds analyzed										**varies**	**varies**
Diesel Range Organics - DRO									**180**		**200**	**HBV**

< = Less than laboratory limit of detection
HRL = Health Risk Limit for Groundwater, Minnesota Department of Health
HBV = Health Based Value for Groundwater, Minnesota Department of Health
MCL = EPA Maximum Contaminant Limit
NE = Not Established
Bold = Concentration above detection limits
= Concentration exceeds HRL/HBV/MCL

Source: STS 2004

Table 6
Private Well Sample Analyses
(ug/L)

	PW-1 (On-Site Well)				RW-1		RW-2	RW-3		RW-4	RW-5	RW-7	RW-8		RW-9	RW-10	RW-11	RW-12			RW-13	Standard	Source
Date	6/12/2003	9/21/2005*	10/10/2005*	4/25/2006	2/12/1990	4/7/2006	4/7/2006	2/12/1990	4/7/2006	4/7/2006	4/7/2006	4/7/2006	2/12/1990	4/7/2006	4/7/2006	2/12/1990	4/18/2006	2/12/1990	2/24/2003	4/18/2006	2/12/1990		
Metals	only metals detected are listed																						
Arsenic	<1	<10	<10	<1	ND	**1.2**	<1	ND	<1	<1	<1	<1	ND	<1	2.2	ND	<1	ND	<1	<1	ND	**10**	**MCL**
Barium	**36.5**	NA	NA	**36.7**	**69.8**	NA	NA	**36.6**	NA	NA	NA	NA	**33.5**	NA	NA	**27.9**	NA	**71.2**	**35**	NA	**27.6**	**2000**	**HRL**
Chromium	**0.73**	<10	<10	<10	NA	<10	<10	NA	<10	<10	<10	<10	NA	<10	<10	NA	<10	NA	<10	<10	NA	**100**	**HRL**
Copper	**52.6**	<10	<10	NA	**7.4**	<10	**17.0**	**32.0**	**12.0**	<10	<10	**15.0**	**50.8**	**12.0**	<10	**15.5**	<10	**10.2**	**14.0**	<10	**9.0**	**1,000**	**HBV**
Iron	NA	<50	<50	NA	**968.0**	NA	NA	**48.9**	NA	NA	NA	NA	**125.0**	NA	NA	**45.1**	NA	**33.7**	NA	NA	**998.0**	**NE**	
Lead	**4.49**	<3	<3	NA	ND	<1	<1	ND	<1	<1	<1	<1	**3.8**	<1	<1	**7.7**	<1	**2.2**	<1	**1.9**	ND	**15****	**EPA**
Manganese	**30.4**	**47.2**	**47.5**	**NA**	**228.0**	NA	NA	**1.7**	NA	NA	NA	NA	**4.5**	NA	NA	**1.5**	NA	**10.6**	<10	NA	**1.7**	**1,000**	**HBV**
Silver	NA	<10	<10	NA	ND	NA	NA	**73.1**	<5	<5	<5	<5	ND	<5	<5	ND	<5	ND	NA	<5	ND	**30**	**HRL**
Thallium	NA	<15.0	**21.2**	<1	**2.7**	<1	<1	**2.3**	<1	<1	<1	<1	ND	<1	<1	ND	<1	ND	NA	<1	ND	**0.6**	**HRL**
Zinc	**32.8**	<20	<20	NA	**57.9**	**76**	<20	**34.4**	<20	<20	**31.0**	**26.0**	**933**	**770.0**	<20	**719.0**	<20	**44.6**	<20	**380**	**64.3**	**2000**	**HRL**

* Sample analyzed by Pace Labs. All other analyses conducted by MDH Public Health Laboratory.
** Federal action level for lead in public water supplies
< = Less than laboratory limit of detection
HRL = Health Risk Limit for Groundwater, Minnesota Department of Health
HBV = Health Based Value for Groundwater, Minnesota Department of Health
MCL = EPA Maximum Contaminant Limit
NE = Not Established
NA = Not Analyzed
ND = Not Detected, detection limits not reported
Bold = Concentration above detection limit
= Concentration exceeds HRL/HBV/MCL

Source: MPCA 1991, STS 2006